Application: the Costs of Taxation

The Effects of a Tax

Eq'm with no tax:
  Price = P_E
  Quantity = Q_E

Eq'm with
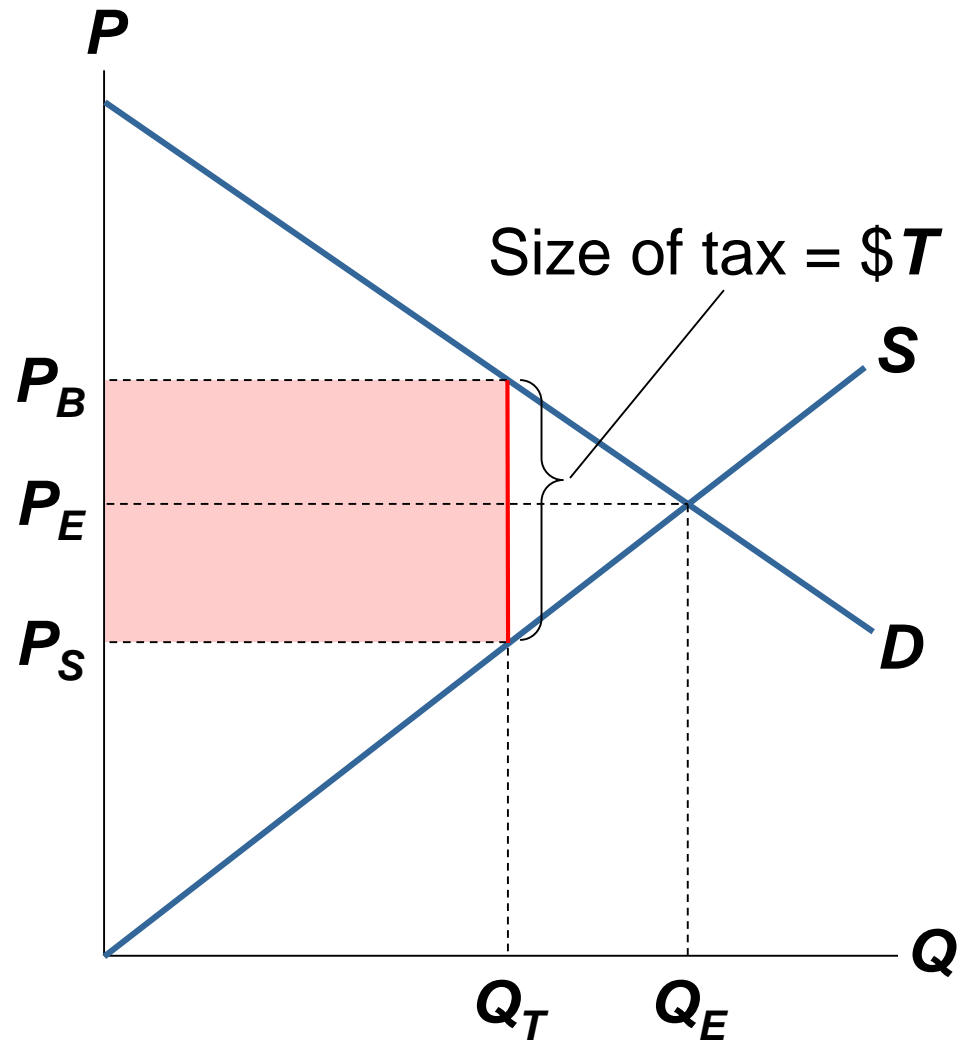tax = $T per unit:
Buyers pay PB
Sellers receive PS
Quantity = QT

Revenue from tax:
$T x Q_T

P

Size of tax = T

S

P_B

P_E

P_S

D

Q_T Q_E

Q

The Effects of a Tax

- Next, we apply welfare economics to measure the gains and losses from a tax.

- We determine consumer surplus (CS), producer surplus (PS), tax revenue, and total surplus with and without the tax.

- Tax revenue can fund beneficial social services (*e.g.*, education, roads, police) so we include it in total surplus.

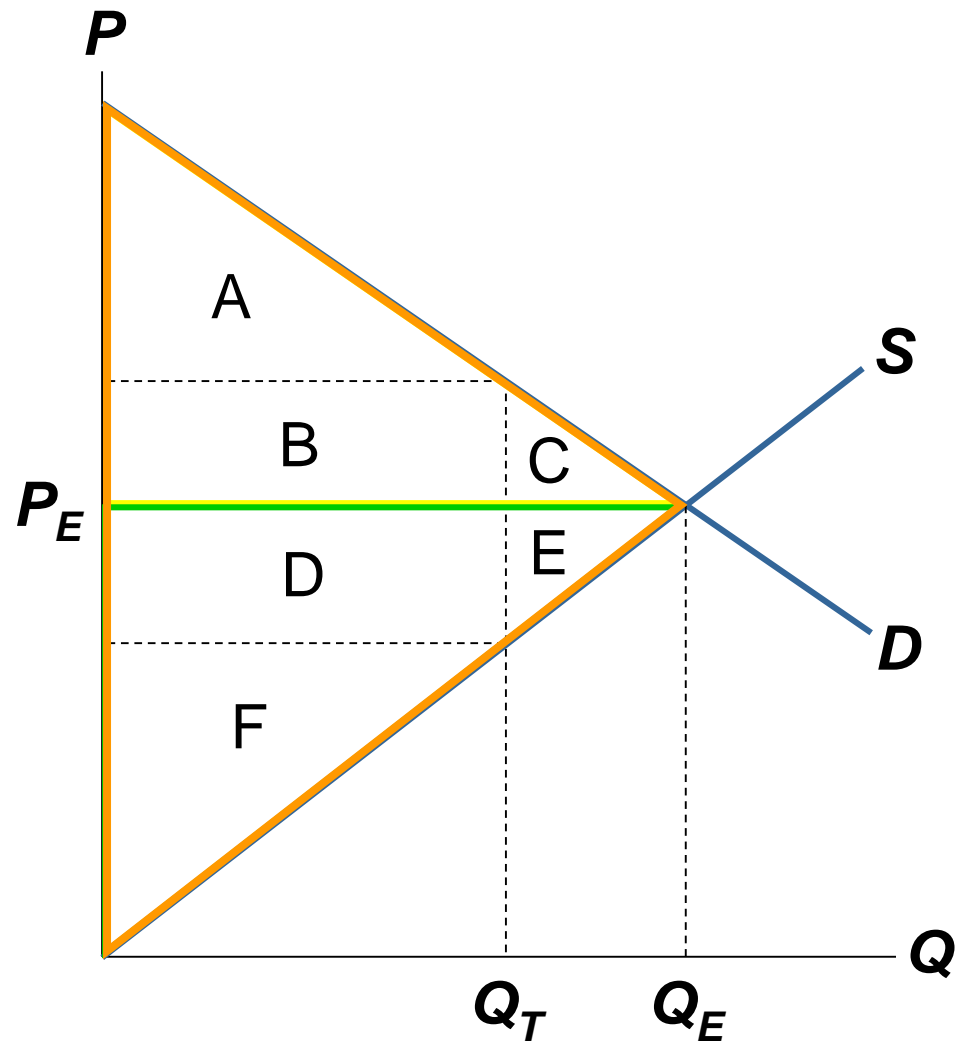# The Effects of a Tax

Without a tax,

CS = A + B + C

PS = D + E + F

Tax revenue = 0

Total surplus
  = CS + PS
  = A + B + C
    + D + E + F

The Effects of a Tax

With the tax,

CS = A

PS = F
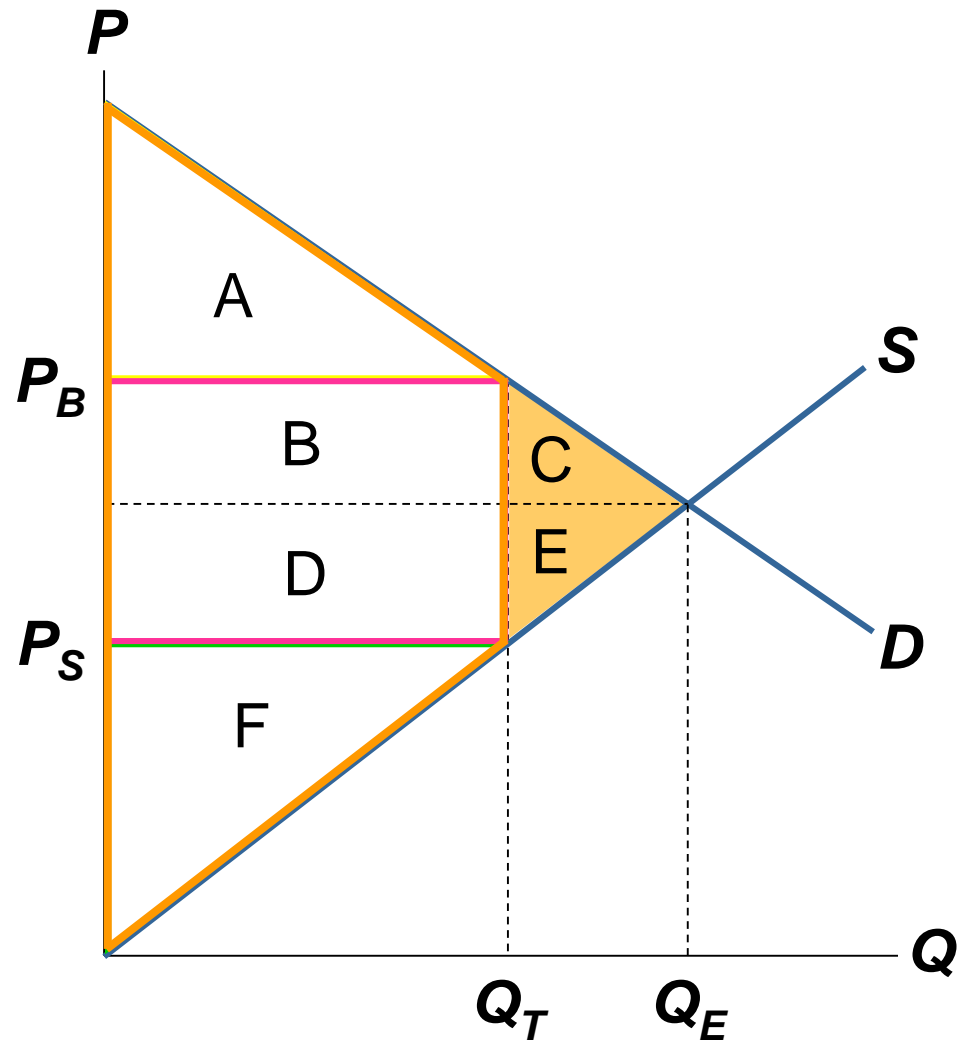
Tax revenue
= B + D

Total surplus
= A + B
+ D + F

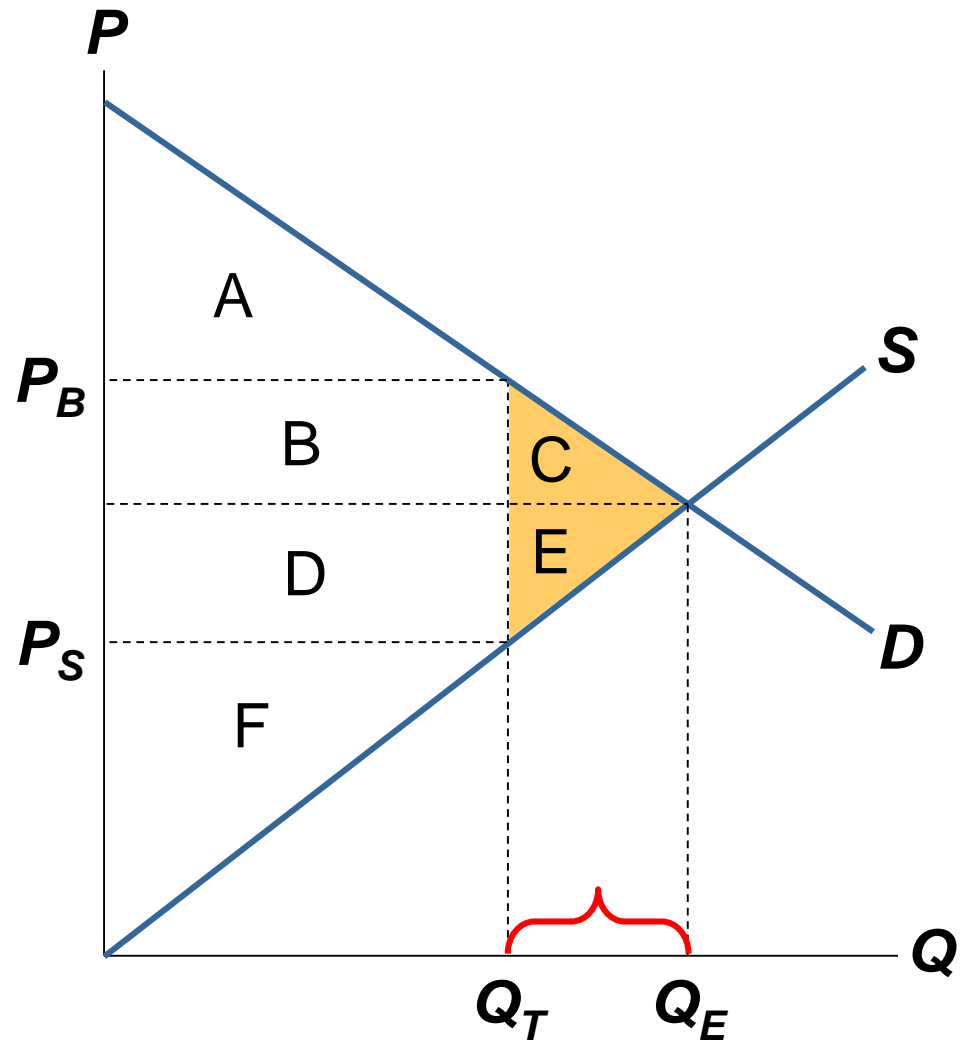The tax reduces
total surplus by
C + E

The Effects of a Tax

C + E is called the **Deadweight Loss** (DWL) of the tax, the fall in total surplus that results from a market distortion, such as a tax.

Because of the tax, the units between Q_T and Q_E are not sold.

The value of these units to buyers is greater than the cost of producing them, so the tax prevents some mutually beneficial trades.
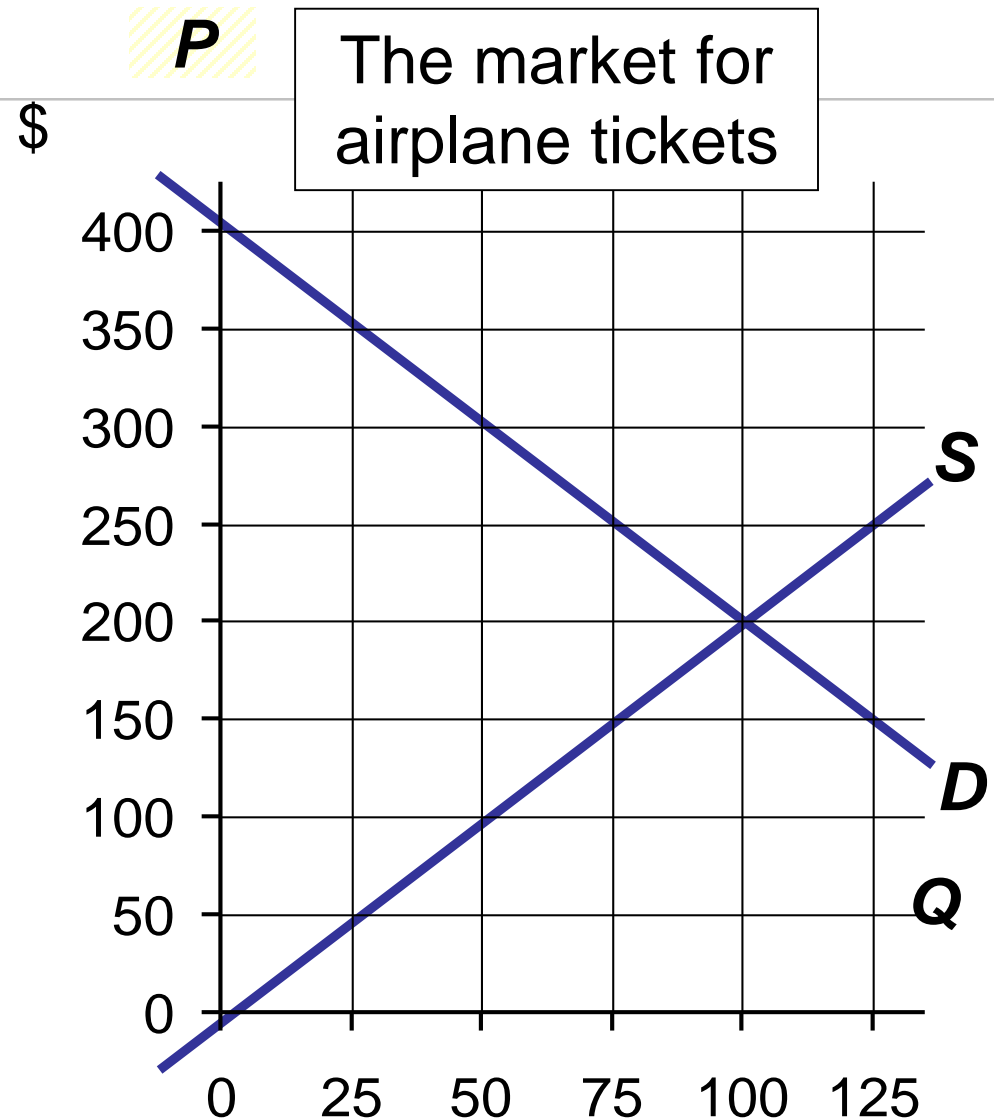
ACTIVE LEARNING 1
Analysis of tax

A. Compute CS, PS, and total surplus without a tax.

B. If $100 tax per ticket, compute CS, PS, tax revenue, total surplus, and DWL.

P

$

The market for airplane tickets

400

350

300   *S*

250

200

150

100   *D*

50   *Q*

0

0   25   50   75   100   125

Answers to A

CS

= ½ x $200 x 100

= $10,000

PS

= ½ x $200 x 100

= $10,000

Total surplus

= $10,000 + $10,000

= $20,000

The market for airplane tickets

P = 200

Answers to B

CS
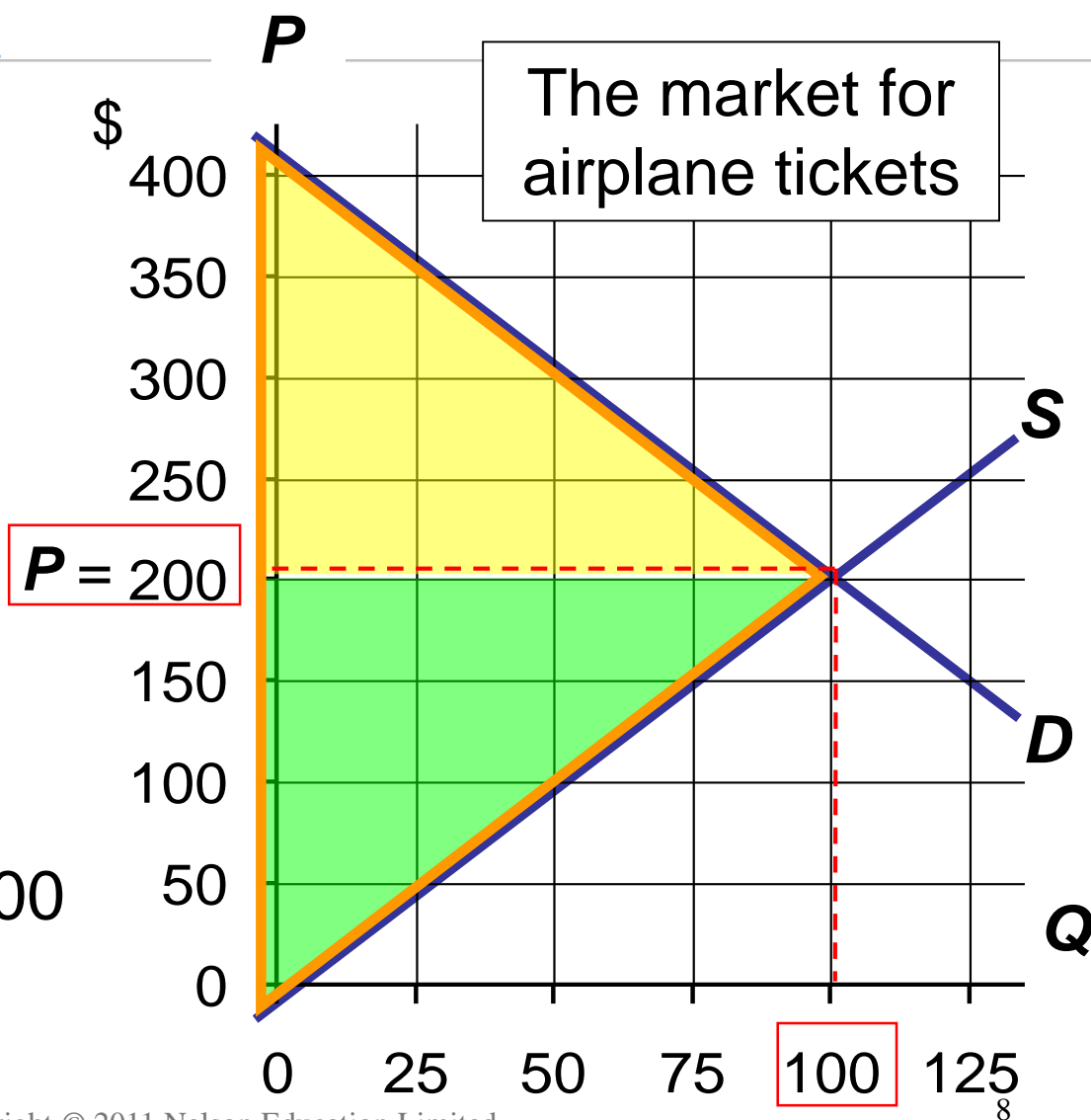
= ½ x $150 x 75

= $5,625

PS = $5,625

Tax revenue

= $100 x 75

= $7,500

Total surplus
= $18,750

DWL = $1,250

A $100 tax on airplane tickets

P

$400

350

300

S

$P_B = 250$

200

$P_S = 150$

100

D

50

0

Q

0   25   50   75   100   125

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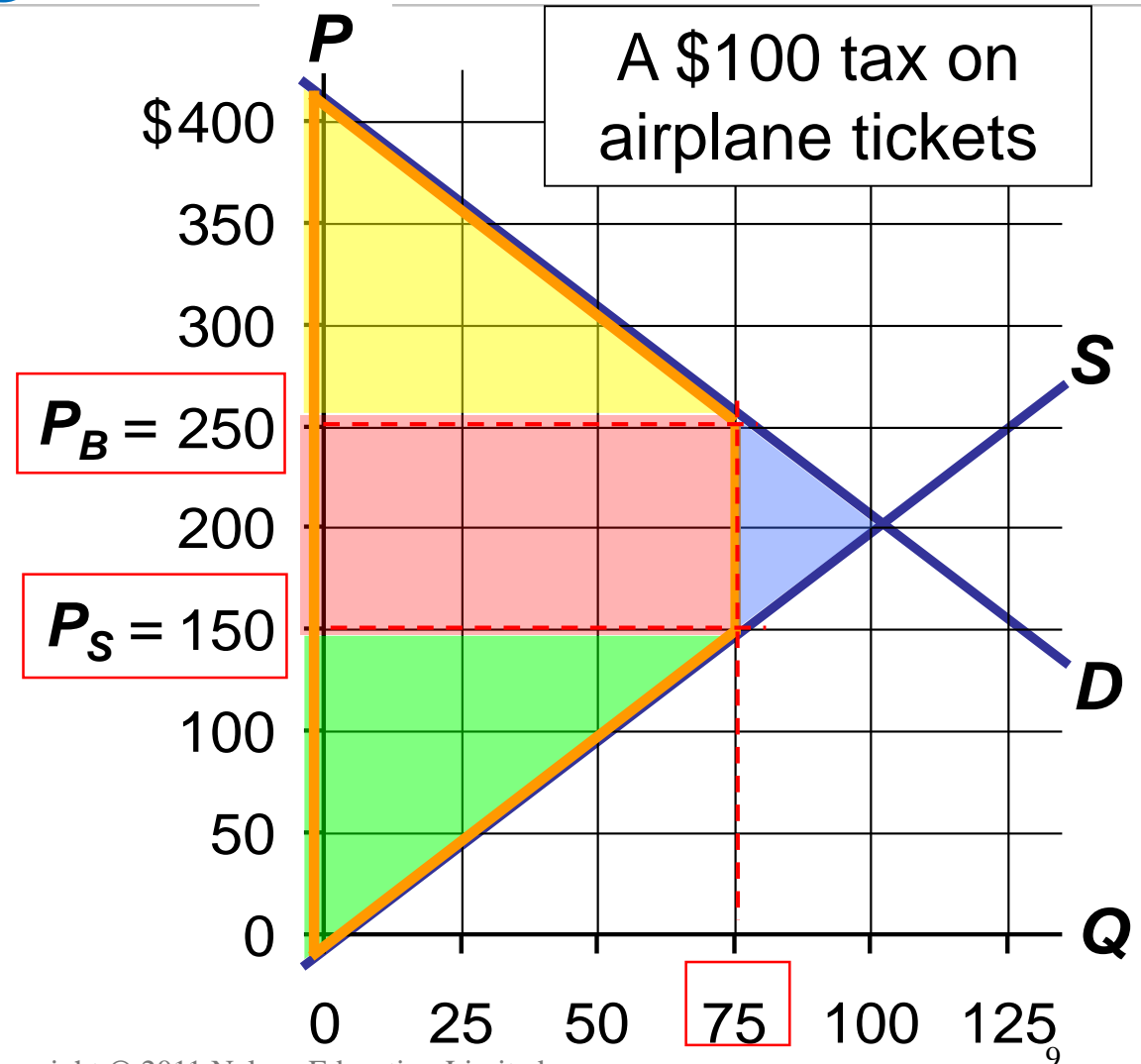
What Determines the Size of the DWL?

- Which goods or services should govt. tax to raise the revenue it needs?

- One answer: those with the smallest DWL.

- When is the DWL small vs. large? It depends on the price elasticities of supply and demand.

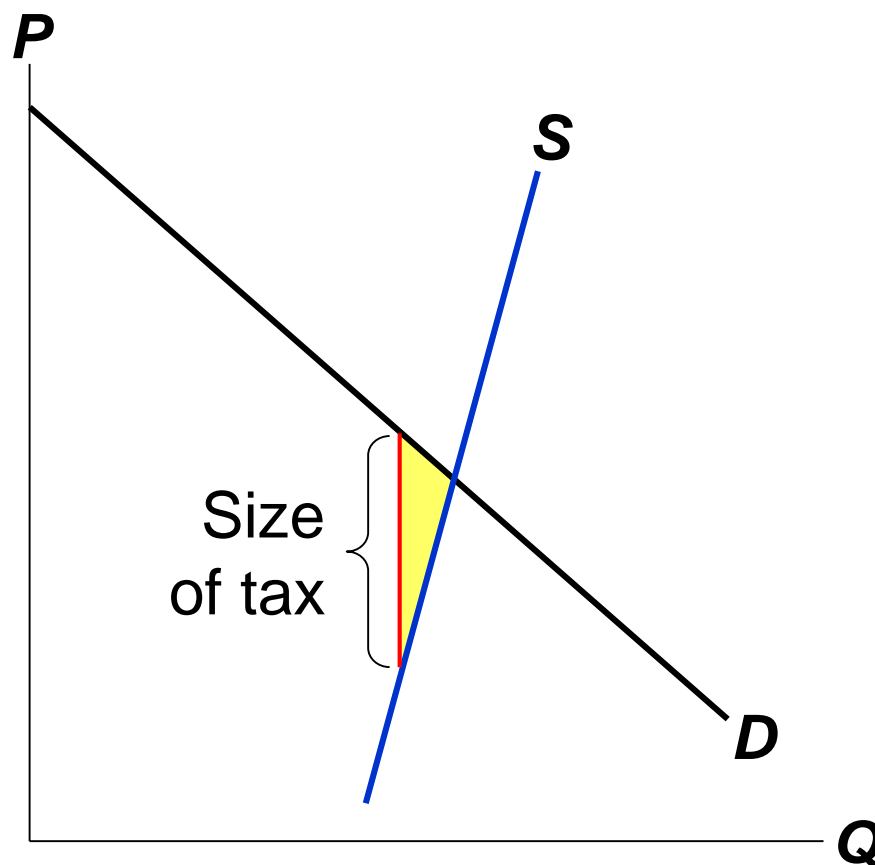 The greater the elasticities of supply and demand, the greater the deadweight loss of a tax

DWL and the Elasticity of Supply

When supply is relatively **<u>inelastic</u>**, it's harder for firms to leave the market. Even when the tax reduces P_S, it only reduces Q a little. So, the DWL is small.

E.g. tax on raw land

DWL and the Elasticity of Supply

When the supply is relatively **elastic**, it is easier for firms to leave the market. When the tax is imposed, the **Q** falls more below the surplus-maximizing quantity. So the DWL is large.

P

S

Size of tax

D

Q

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DWL and the Elasticity of Demand

P

S

Size
of tax

D

Q
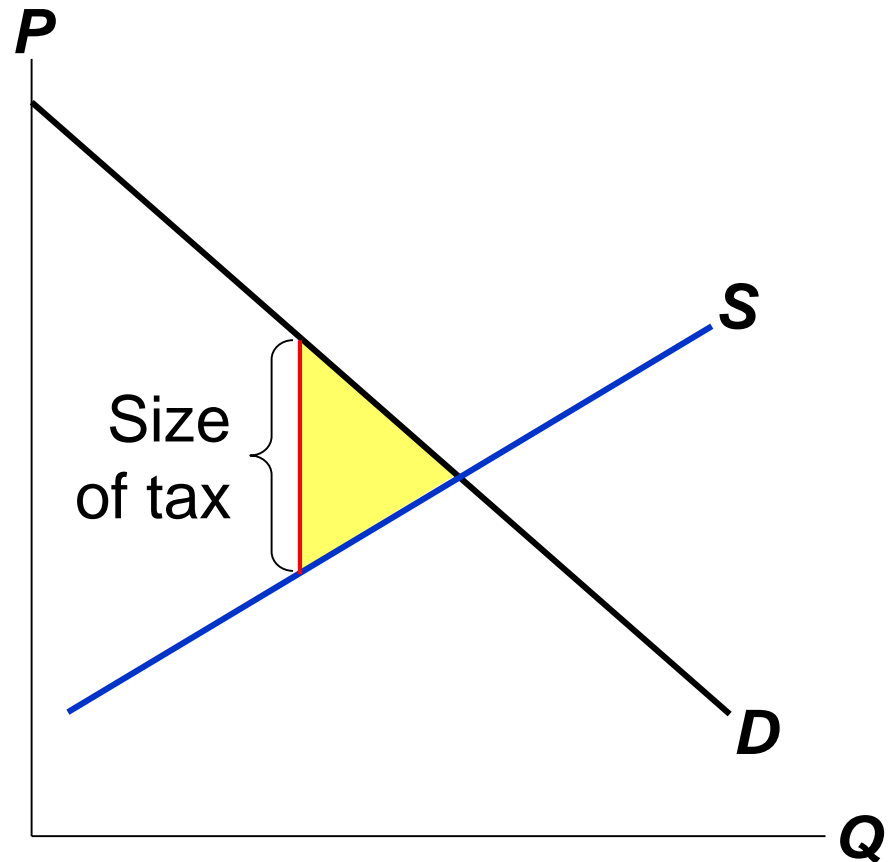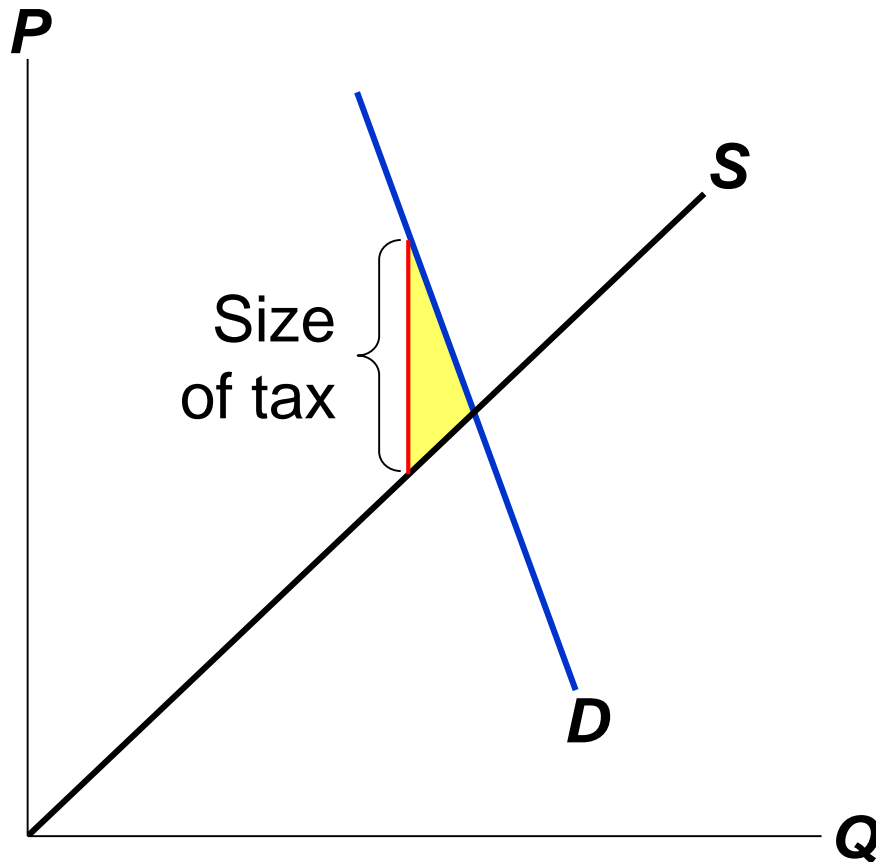
When demand is relatively inelastic, it's harder for consumers to leave the market. Even when the tax raises P_B, it only recues Q a little, So, DWL is small.

DWL and the Elasticity of Demand

P

S

Size
of tax

D

Q

When the demand is relatively elastic, it is easier for buyers to leave the market. When the tax is imposed, the **Q** falls more below the surplus-maximizing quantity. So, the DWL is large.
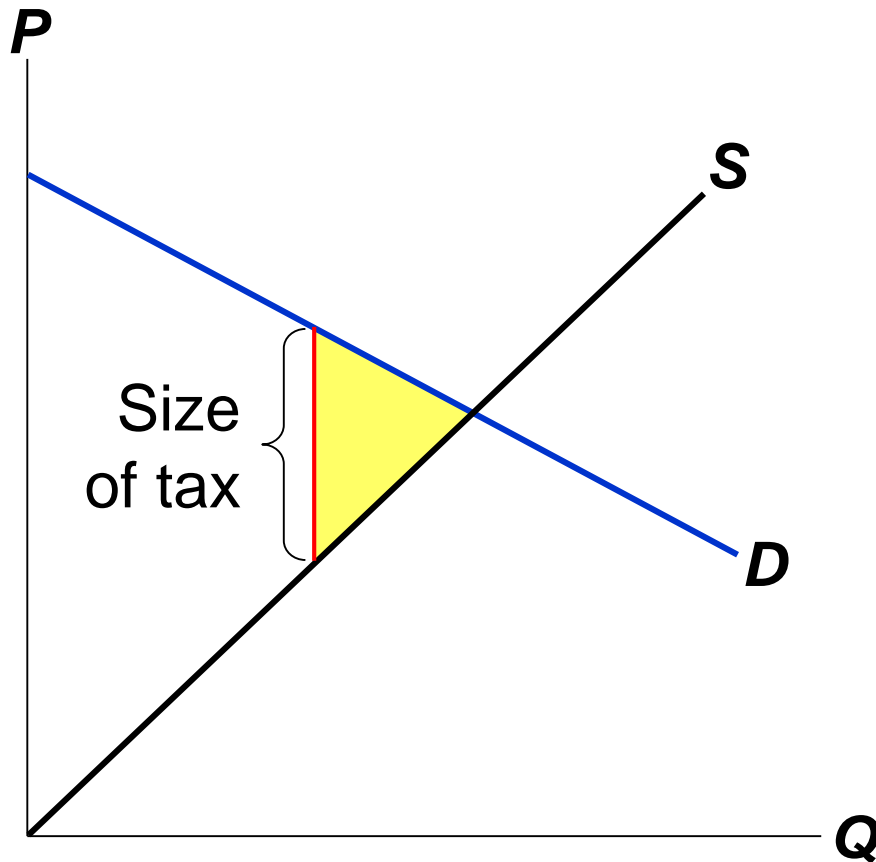
Which goods should the govt tax more?

Cigarettes (US)[39]	Rice[46]
−0.3 to −0.6 (General)	−0.47 (Austria)
−0.6 to −0.7 (Youth)	−0.8 (Bangladesh)
Alcoholic beverages (US)[40]	−0.8 (China)
−0.3 or −0.7 to −0.9 as of 1972 (Beer)	−0.25 (Japan)
−1.0 (Wine)	−0.55 (US)
−1.5 (Spirits)	Cinema visits (US)
Airline travel (US)[41]	−0.87 (General)[44]
−0.3 (First Class)	Live Performing Arts (Theater, etc.)
−0.9 (Discount)	−0.4 to −0.9[47]
−1.5 (for Pleasure Travelers)	Transport
Livestock	−0.20 (Bus travel US)[44]
−0.5 to −0.6 (Broiler Chickens)[42]	−2.8 (Ford compact automobile)[48]
Oil (World)	Soft drinks
−0.4	−0.8 to −1.0 (general)[49]
Car fuel[43]	−3.8 (Coca-Cola)[50]
−0.09 (Short run)	−4.4 (Mountain Dew)[50]
−0.31 (Long run)	Steel
Medicine (US)	−0.2 to −0.3[51]
−0.31 (Medical insurance)[44]	Eggs
−.03 to −.06 (Pediatric Visits)[45]	−0.1 (US: Household only),[52] −0.35 (Canada),[53] −0.55 (South Africa)[54]

Price Elasticity - Demand

Source: Wikipedia, http://en.wikipedia.org/wiki/Price_elasticity_of_demand#cite_note-ayers120-50

The Effects of a Tobacco Tax

Between 1982 and 1992,

- the Canadian government increased tobacco taxes by 500%, which caused a significant 40% decline in per capita consumption of cigarettes.

- Among youth, daily smoking prevalence declined by 60%.

- Federal and provincial tax revenues increased by 240%.

However, in response to an increase in illegal cigarette smuggling (mainly from the U.S.), in 1994 the Government of Canada drastically reduced tobacco taxes in an attempt to control the smuggling.

- In the years following 1994 tax revenues sharply decreased and then gradually rose as taxes were slowly increased after 1994.

- The lowering of tax revenues after 1994 was accompanied by a sharp increase in cigarette consumption and consequently, health damage caused by smoking, as experienced in Canada and other countries.

A C T I V E   L E A R N I N G   2
Elasticity and the DWL of a tax

Would the DWL of a tax be larger if the tax were on:

A. Breakfast cereal or sunscreen?

B. Hotel rooms in the short run or hotel rooms in the long run?

C. Groceries or meals at fancy restaurants?

ACTIVE LEARNING 2
Answers

C. Groceries or meals at fancy restaurants

Groceries are more of a necessity and therefore less price-elastic than meals at fancy restaurants.

So, a tax on restaurant meals would cause a larger DWL than a tax on groceries.

How Big Should the Government Be?

- Countries need a state of a certain size to provide essential public services such as healthcare and education.

- How much a state spends often matters less than how it spends. Systems in which the state pays and the private sector provides often work well.

- A bigger government provides more services, but requires higher taxes, which cause DWLs.

- The larger the DWL from taxation, the greater the argument for smaller government.

Example: Labour Taxes

- If labor supply is inelastic, then this DWL is small.

- Some economists believe labor supply is inelastic, arguing that most workers work full-time regardless of the wage.

- Other economists believe labor taxes are highly distorting because some groups of workers have elastic supply and can respond to incentives:
    - Many workers can adjust their hours, *e.g.,* by working overtime.
    - Many families have a 2nd earner with discretion over whether and how much to work.
    - Many elderly choose when to retire based on the wage they earn.
    - Some people work in the "underground economy" to evade high taxes.
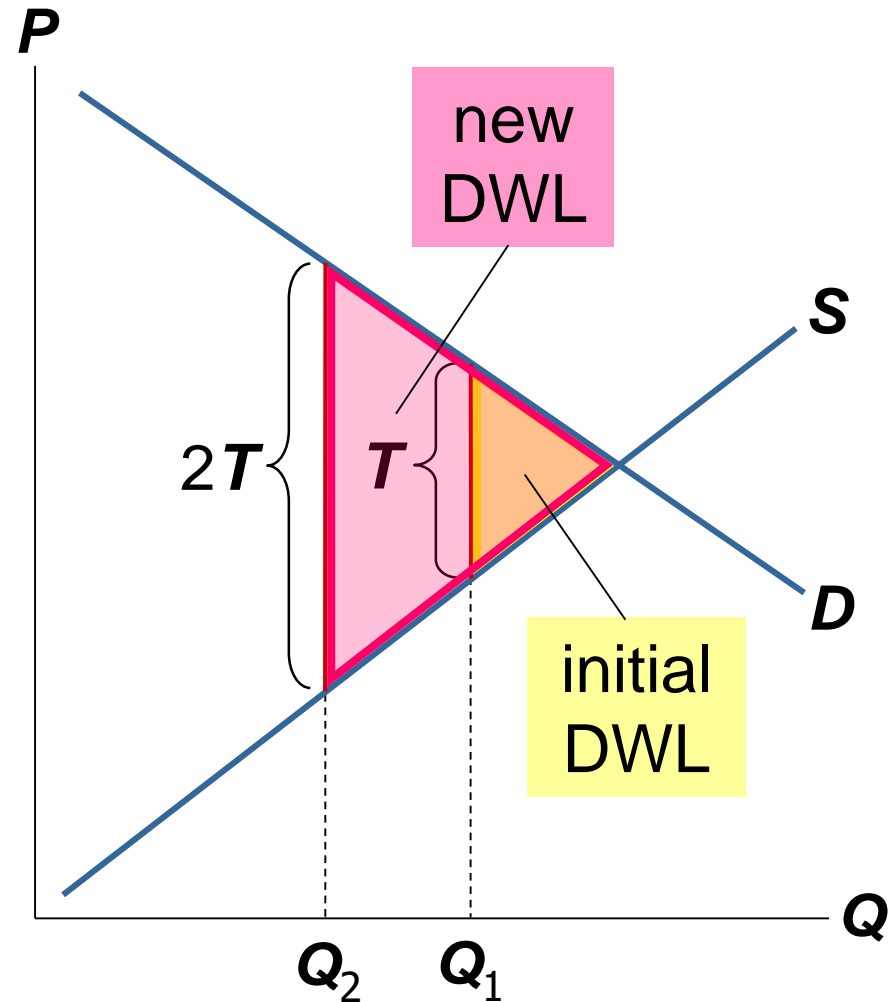
The Effects of Changing the Size of the Tax

- Policymakers often change taxes, raising some and lowering others.

- What happens to DWL and tax revenue when taxes change? We explore this next….

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DWL and the Size of the Tax
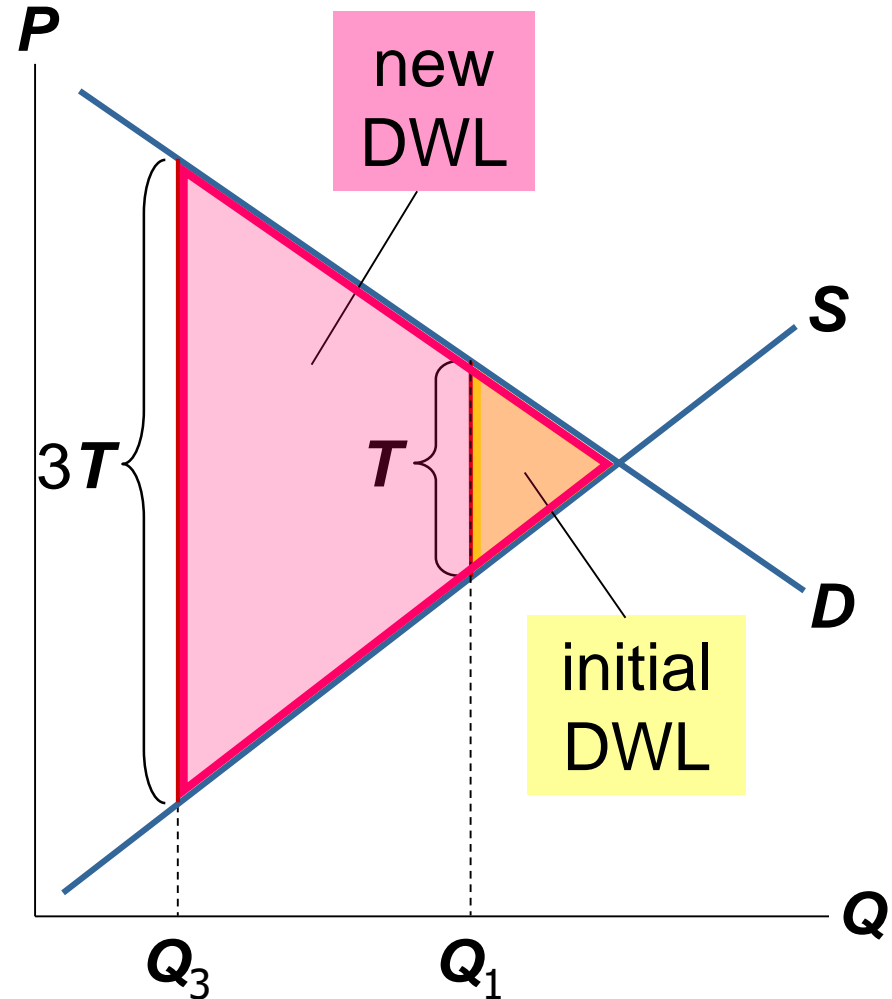
Initially, the tax is **T** per unit.

Doubling the tax causes the DWL to more than double.

DWL and the Size of the Tax

Initially, the tax is T per unit.

Tripling the tax causes the DWL to more than triple.

DWL and the Size of the Tax
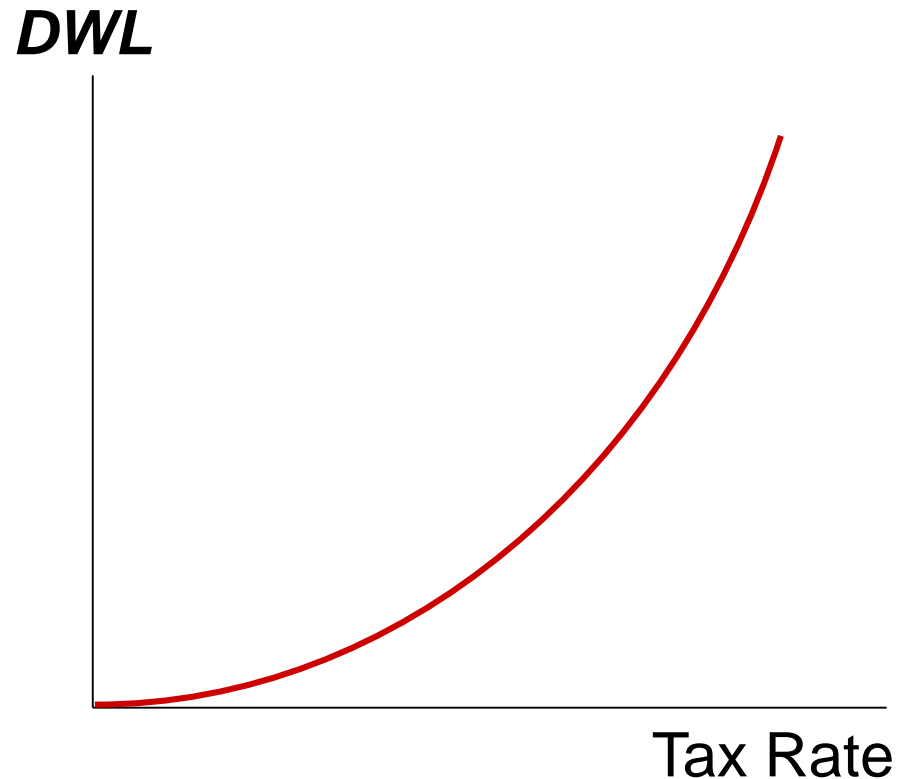
Implication

From the previous slides we learn that DWL continually increases at an increasing rate.

When tax rates are low, raising them doesn't cause much harm, and lowering them doesn't bring much benefit.

When tax rates are high, raising them is very harmful, and cutting them could be beneficial.

Summary

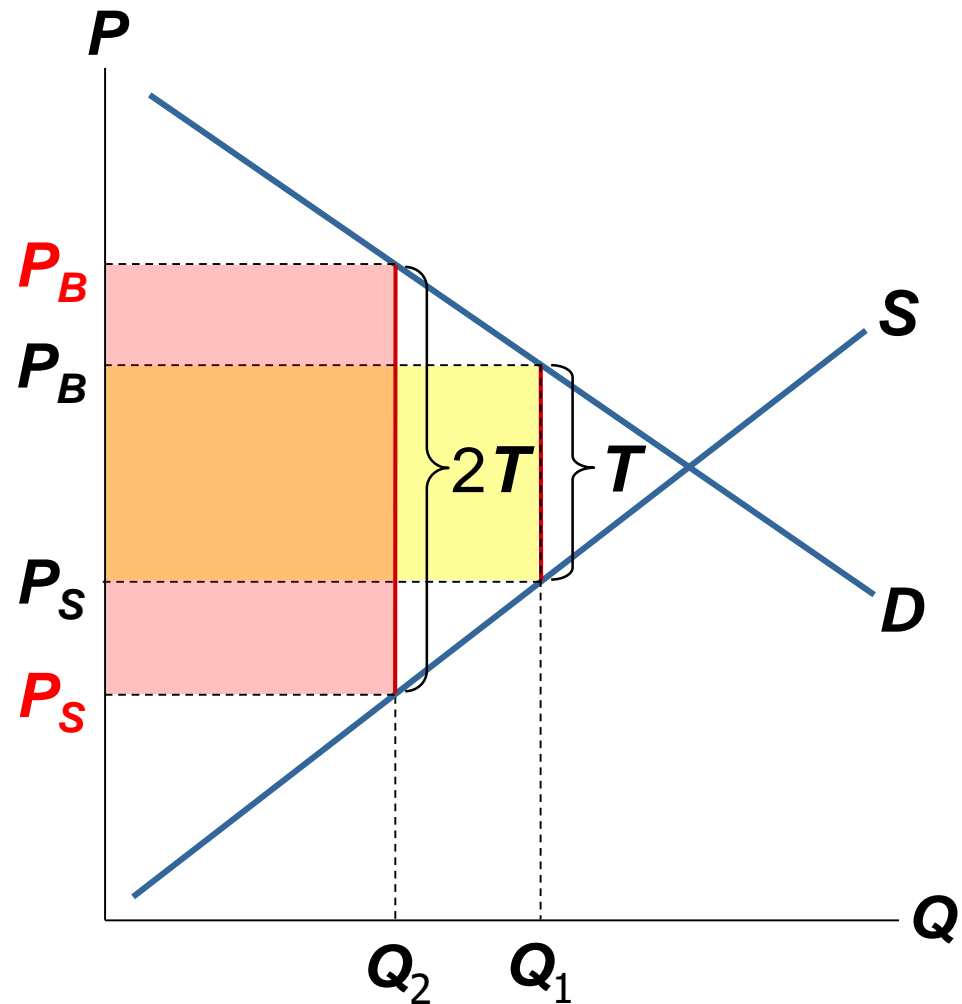**_When a tax increases, DWL rises even more._**

DWL

Tax Rate

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Revenue and the Size of the Tax

When the tax is small (namely, equal to T), the shaded yellow rectangle represents tax revenue.

When the tax equals 2T, the pink shaded box represents revenue.

The pink shaded box is larger than the yellow box.

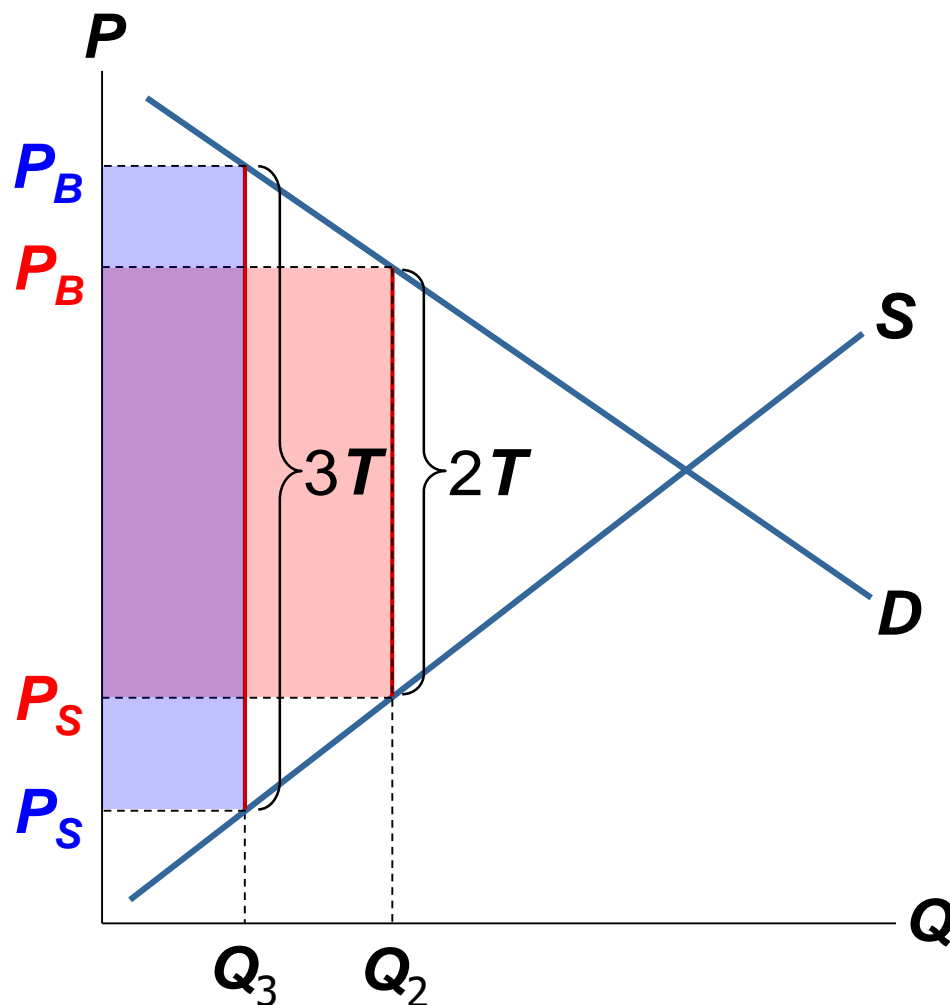Hence, increasing tax rate causes tax revenue to rise

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Revenue and the Size of the Tax

When the tax is larger, increasing it causes tax revenue to fall.

Raising the tax further – to 3T – causes revenue to fall.

Revenue is now represented by the bluish-purple shaded box, which is smaller than the pink box.

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Laffer Curve

The **Laffer curve** shows the relationship between the rate of the tax and tax revenue.

This diagram suggests that raising tax rates initially increases revenue, but beyond a certain level revenue falls instead as tax rates continue to rise. That is, at some point tax rates are so high and reduce the number of transactions so greatly that tax revenues fall.

Note: the peak of the graph does not mean 50% tax rate. It can be any rate and depends on specific type of tax.

The Laffer curve

Tax revenue
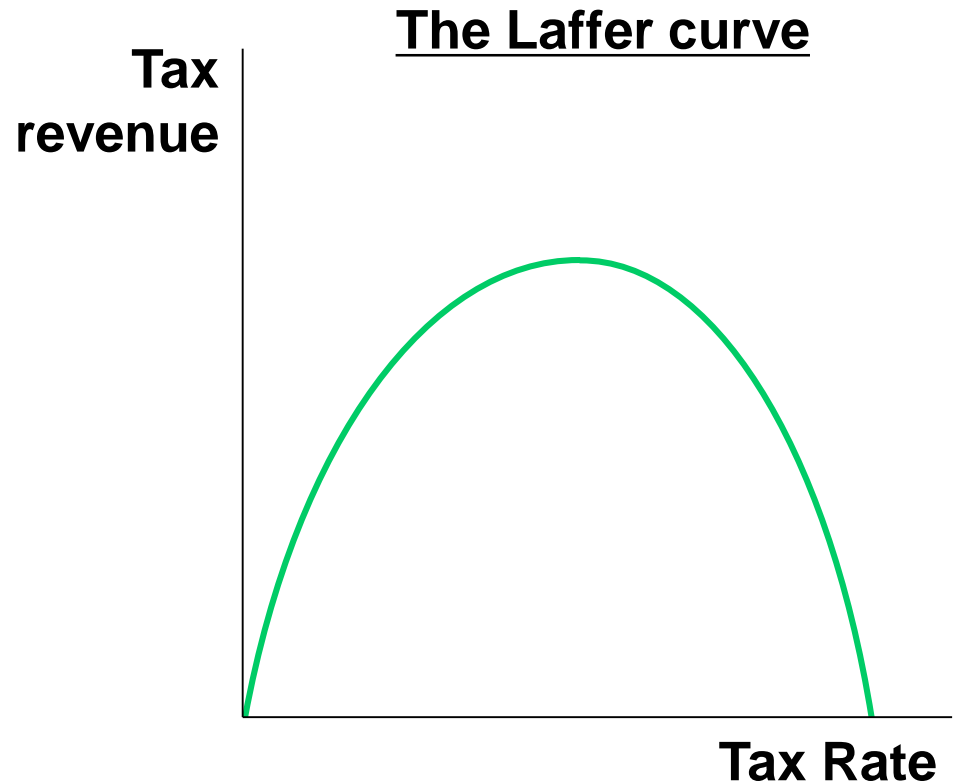
Tax Rate

Example: Sweden in the early 1980s had a marginal income tax rate of about 80%.

Tax Rates and Tax Revenues

Some effects changes in tax rates have on revenues:

- *Arithmetic effect*

    Lower tax rates → lower tax revenues (smaller tax base)

- *Economic effect*

    Lower tax rates → more incentives to increase work and output → Faster growing economy → lower unemployment , higher tax revenues

- *Expenditure effect*

    Lower unemployment → less spending on unemployment benefits and other social welfare programs → more balanced government budget

When these effects are combined, the consequences of the change in tax rates on total tax revenues are no longer quite so obvious.